“Number Walls” Investigation

(Investigation Designed by Isabel Dykes)

This investigation will be assessed using the MYP Mathematics Criteria B and C

1. Choose four numbers and, on a “Number Wall” like the one opposite, enter one number in each of the bricks on the bottom line.

33

22

11

15

7

4

1. Working from one end, add the numbers together in pairs and write the total in the brick directly above. Repeat the process until you have filled in the top brick.
2. Now, using the same numbers, but arranging them in different ways on the bottom row, try doing this again. What do you notice? Is this what you expected would happen?
3. Can you find rules for arranging the numbers so you get the maximum and minimum possible totals on the top brick?
4. Investigate whether your rules still work if you use different numbers on the bottom row.
5. Now increase the number of bricks on the bottom line – try an odd number of bricks.
6. Can you find general rules that would work for “Number Walls” of any size? Explain how and why these rules work.

You are now going to try to do the problem again, this time with letters. The first “Letter Wall” have been done for you.

1

2

1

A+2B+C

B+C

A+B

A

C

B

1. Now, try making a “Letter Wall” using four letters, A, B, C and D.
2. Create more “Letter Walls.” Put the numbers you get in each top brick into a separate wall. The first “Letter Wall” has been entered for you. Can you spot a pattern for the numbers you get each time?
3. Without drawing a wall, can you use your rule to predict what you would get on the top brick if you used 8 bricks (A to H) on the bottom?

You are now going to use what you learned about expanding brackets to investigate where this pattern could be used to make life easier.

1. Expand (x + y)2 and write down the answer.
2. Now expand (x + y)3. Don’t forget, this is (x + y)(x + y)2 – it will make your job easier.
3. Now compare your answers to parts 11 and 12 with your wall in part 9. What do you notice?
4. If you feel brave enough, try expanding (x + y)4. How did you use the wall to help you? Can you write down the expansion of (x + y)8? Again, explain how you used the wall to help you.

“Number Walls” Investigation

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Criterion B – Investigating Patterns

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| **Achievement**  **Level** | **Level Descriptor** | **Task Specific Clarification** |
| **0** | The student does not reach a standard described by any of the descriptors given below. | |
| **1-2** | The student **applies, with some guidance**, mathematical problem-solving techniques to recognize **simple** patterns. | ▪ You were able to follow the instructions and create some “Number Walls.”  ▪ You tried to find rules for getting maximum and minimum totals on the top brick |
| **3-4** | The student **selects and applies** mathematical problem-solving techniques to recognize patterns, and **suggests** relationships or general rules. | ▪ You found the correct rule for the maximum and minimum totals.  ▪ You tried to explain how this worked.  ▪ You tried to create some “Letter Walls”, but you made mistakes.  ▪ You tried to expand the brackets in parts 11 and 12 but were not really successful |
| **5-6** | The student **selects and applies** mathematical problem-solving techniques to recognize patterns, **describes** them as relationships or general rules, and **draws conclusions** consistent with findings. | ▪ You gave a brief explanation of why your rules for “Number Walls” worked.  ▪ You correctly completed several “Letter Walls” and used this to fill in the wall in part 9.  ▪ You tried to predict what would happen with 8 letters.  ▪ You could expand the brackets in parts 11 and 12 and tried to answer part 14. |
| **7-8** | The student **selects and applies** mathematical problem-solving techniques  to recognize patterns, **describes** them as relationships or general rules, **draws conclusions** consistent with findings, and **provides justifications or proofs**. | ▪ You explained fully why your rules for “Number Walls” worked.  ▪ You found the correct answer for the 8 letter wall.  ▪ You correctly expanded the brackets for (x + y)4.  ▪ You were able to make the connection between the wall in part 9 and those expansions.  ▪ You could use this to write down the expansion of (x + y)8 and you explained how you did this. |

Additional Comments:

Criterion C – Communication

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| **Achievement**  **Level** | **Level Descriptor** | **Task Specific Clarification** |
| **0** | The student does not reach a standard described by any of the descriptors given below. | |
| **1-2** | The student shows **basic** use of mathematical language **and/or** forms of mathematical representation. The lines of reasoning are **difficult to follow**. | ▪ You made use of the number wall grids and basic algebraic language to explain your solutions. However, your thinking was difficult to follow. |
| **3-4** | The student shows **sufficient** use of mathematical language **and** forms of mathematical representation. The lines of reasoning are **clear** though not always **logical** or **complete**. The student moves between different forms of representation **with some success**. | ▪ You made good use of the grids and algebraic language and you were able to link these together quite well to explain your solutions.  ▪ Your reasoning was clear but it was not always logical and you sometimes missed steps |
| **5-6** | The student shows **good** use of mathematical language **and** forms of mathematical representation. The lines of reasoning are **concise**, **logical** and **complete**. The student moves **effectively** between different forms of representation. | ▪ You made excellent use of the grids and algebraic language and you linked them together very effectively to explain your solutions.  ▪ Your reasoning was very clear and logical and you investigated all aspects of the problems. |

Additional Comments: